

CLAIMS

What is claimed is:

5 1. A network device for transmitting compressed video data onto a channel, the network  
device comprising:

a bit rate converter designed or configured to transcode compressed video data;

a multiplexer designed or configured to

a) schedule packets from the multiple bitstreams;

b) periodically determine if bandwidth is available on the channel prior to or

10 after transcoding is performed when needed on the compressed video data, and if so,  
allocating additional packets from the multiple bitstreams to use the available bandwidth; and

a network interface designed or configured to output data packets from the bitstreams  
onto the channel.

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2. The network device of claim 1 wherein the multiplexer comprises a bandwidth  
arbitrator that is designed or configured to divide the available bandwidth substantially  
equally among the multiple bitstreams.

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3. The network device of claim 2 wherein the bandwidth arbitrator periodically  
determines and allocates the available bandwidth on a temporal basis.

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4. The network device of claim 2 wherein the bandwidth arbitrator periodically  
determines a decoder buffer level for each of the bitstreams.

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5. The network device of claim 2 wherein the multiplexer is designed or configured to  
alter the scheduling of packets according to the bit rate of incoming bitstreams.

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6. The network device of claim 2 further comprising a rate controller, coupled to the  
bandwidth arbitrator and the bit rate converter, and designed or configured to output a control  
signal that determines the amount of rate reduction when transcoding the compressed video  
data.

7. The network device of claim 1 wherein the processor is designed or configured to model downstream decoder buffer levels corresponding to each of the bitstreams.

5 8. The network device of claim 1 wherein the scheduler is included in a statistical multiplexer.

10 9. A method for transmitting compressed video data onto a channel, the method comprising:

receiving multiple bitstreams, each bitstream including compressed video data contained in packets;

transcoding compressed video data in one or more of the multiple bitstreams;

scheduling the packets from the multiple bitstreams;

determining an available bandwidth on the channel;

allocating the available bandwidth to one or more of the multiple bitstreams; and

transmitting data packets from each of the multiple bitstreams onto the channel.

10. The method of claim 9 wherein the available bandwidth is determined on a periodic basis.

11. The method of claim 10 wherein the available bandwidth is periodically determined 25 on one of a temporal, bit or a packet basis.

12. The method of claim 11 wherein the available bandwidth is periodically determined about every 10 milliseconds to about every 250 milliseconds.

30 13. The method of claim 9 wherein the available bandwidth is allocated according to a minimum bandwidth requirement for a downstream decoder.

14. The method of claim 9 wherein the available bandwidth is allocated inversely proportional to a downstream decoder buffer level.

15. The method of claim 9 further comprising modeling a downstream decoder buffer level corresponding to one of the multiple bitstreams.
- 5 16. The method of claim 15 wherein the available bandwidth is allocated to a bitstream having a lower modeled downstream decoder buffer level than another bitstream having a higher modeled downstream decoder buffer level.
- 10 17. The method of claim 15 wherein the available bandwidth on the channel is allocated inversely proportional to the modeled downstream decoder buffer level.
- 15 18. The method of claim 8 wherein the available bandwidth on the channel allocated proportional to the minimum bandwidth requirement of each downstream decoder buffer level.
- 20 19. A network device for transmitting compressed video data onto a channel, the network device comprising:  
means for receiving multiple bitstreams, each bitstream including compressed video data contained in packets;  
means for transcoding compressed video data in one or more of the multiple bitstreams;  
means for scheduling the packets from the multiple bitstreams;  
means for determining an available bandwidth on the channel;  
25 means for allocating the available bandwidth to one or more of the multiple bitstreams; and  
means for transmitting data packets from each of the multiple bitstreams onto the channel.
- 30 20. The network device of claim 19 further comprising means, coupled to the means for scheduling and the means for transcoding, for outputting a control signal that determines the amount of rate reduction when transcoding the compressed video data.

21. The network device of claim 19 further comprising means for modeling a downstream decoder buffer level corresponding to one of the multiple bitstreams.

5 22. A computer readable medium including instructions for transmitting compressed  
video data onto a channel, the instructions comprising:  
instructions for receiving multiple bitstreams, each bitstream including compressed  
video data contained in packets;  
instructions for transcoding compressed video data in one or more of the multiple  
10 bitstreams;  
instructions for scheduling the packets from the multiple bitstreams;  
instructions for determining an available bandwidth on the channel;  
instructions for allocating the available bandwidth to one or more of the multiple  
bitstreams; and  
instructions for transmitting data packets from each of the multiple bitstreams onto  
the channel.